CLAIMS

What is claimed is:

1. A method for temporarily assisting a heart of a patient, the patient wearing ECG sensors with attached electrodes, the method comprising the steps of:

   a. inserting an occluding device, having a pressure sensor, into the patient's descending aorta;

   b. positioning the occluding device near the level of the patient's diaphragm;

   c. coupling the occluding device to an extra-corporeal controller; and

   d. opening and closing the balloon in response to signals from the ECG electrodes.

2. The method of claim 1, wherein the step of closing occurs just prior to the start of cardiac systole and ventricular ejection.

3. The method of claim 2, further comprising the step of using an extra-corporeal pump to continuously pump blood from a patient's supra-diaphragmatic artery to an infra-diaphragmatic artery.

4. The method of claim 3, wherein in the step of continuously pumping blood, the pumping flow rate varies in response to the end-systolic pressure measured in the upper arterial compartment of the patient's body.

5. The method of claim 4, wherein the extra-corporeal controller a) causes the occluding device to intermittently occlude the aorta, synchronously with the patient's cardiac cycle, and b) causes the extra-corporeal pump to pump blood from the patient's proximal to the distal aorta at a rate sufficient to pressure and volume unload the patient's failing left ventricle.

6. The method of claim 5, wherein the extra-corporeal controller decreases the flow rate and RPM of the extra-corporeal pump when it opens the occluding device.

7. The method of claim 6, wherein an inlet cannula of the extra-corporeal pump is inserted through an aortic valve into the left ventricle, the inlet cannula having holes along a length of it positioned in the aorta, and a hole in a tip, which is positioned in the left ventricle, for providing direct unloading of the left ventricle, and after-load reduction in the aorta.

8. A method for temporarily assisting a heart of a patient, the patient wearing ECG sensors with attached electrodes, the method comprising the steps of:

a. inserting a balloon, having a balloon catheter and two pressure sensors, into the patient's descending aorta;

b. positioning the balloon near the level of the patient's diaphragm;

c. coupling the balloon catheter to an extra-corporeal controller;

d. inflating the balloon in response to signals from the ECG electrodes, and the two pressure sensors; and

e. deflating the balloon in response to signals from the ECG electrodes, and the two pressure sensors.

9. The method of claim 8, wherein the step of inflating occurs just prior to the start of cardiac systole and ventricular ejection.

10. The method of claim 9, further comprising the step of using an extra-corporeal pump to continuously pump blood from a patient's supra-diaphragmatic artery to an infra-diaphragmatic artery.

11. The method of claim 10, wherein in the step of continuously pumping blood, the pumping flow rate varies in response to the end-systolic pressure measured in the upper arterial compartment of the patient's body.

12. The method of claim 11, wherein the extra-corporeal controller a) causes the balloon to intermittently occlude the aorta, synchronously with the patient's cardiac cycle, and b) causes the extra-corporeal pump to pump blood from the patient's proximal to the distal aorta at a rate sufficient to pressure and volume unload the patient's failing left ventricle.

13. The method of claim 12, wherein the extra-corporeal controller decreases the flow rate and RPM of the extra-corporeal pump when it deflates the balloon.

14. A method for temporarily assisting a heart of a patient, the patient wearing ECG sensors with attached electrodes, and the patient also having an intra-aortic occluding device having two pressure sensors, the method comprising the steps of:

a. opening and closing the intra-aortic occluding device by an extra-corporeal controller in response to signals from the ECG electrodes and the two pressure sensors; and

b. continuously pumping blood by an extra-corporeal pump from a patient's supra-diaphragmatic artery to an infra-diaphragmatic artery

15. The method of claim 14, wherein the step of closing occurs just prior to the start of the patient's cardiac systole and ventricular ejection.

16. The method of claim 15, wherein the pumping flow rate varies in response to the end-systolic pressure measured in the upper arterial compartment of the patient's body.

17. The method of claim 16, wherein the extra-corporeal controller a) causes the occluding device to intermittently occlude the aorta, synchronously with the patient's cardiac cycle, and b) causes the extra-corporeal pump to pump blood from the patient's proximal to the distal aorta at a rate sufficient to pressure and volume unload the patient's failing left ventricle.

18. The method of claim 11, wherein the extra-corporeal controller decreases the flow rate and RPM of the extra-corporeal pump when it opens the occluding device.

19. A method for temporarily assisting a heart of a patient, the patient wearing ECG sensors with attached electrodes, and the patient also having an intra-aortic balloon having two pressure sensors, the method comprising the steps of:

a. inflating the intra-aortic balloon by an extra-corporeal controller in response to signals from the ECG electrodes and the two pressure sensors;

b. deflating the intra-aortic balloon by an extra-corporeal controller in response to signals from the ECG electrodes and the two pressure sensors; and

c. continuously pumping blood by an extra-corporeal pump from a patient's supra-diaphragmatic artery to an infra-diaphragmatic artery.

20. The method of claim 19, wherein the step of inflating occurs at the onset or during the patient's cardiac systole and ventricular ejection.

21. The method of claim 20, wherein the pumping flow rate varies in response to the end-systolic pressure measured in the upper arterial compartment of the patient's body.

22. The method of claim 21, wherein the extra-corporeal controller a) causes the balloon to intermittently occlude the aorta, synchronously with the patient's cardiac cycle, and b) causes the extra-corporeal pump to pump blood from the patient's proximal to the distal aorta at a rate sufficient to pressure and volume unload the patient's failing left ventricle.

23. The method of claim 22, wherein the extra-corporeal controller decreases the flow rate and RPM of the extra-corporeal pump when it deflates the balloon.